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STRUGGLE FOR SUSTAINABLE PUBLIC TRANSPORT IN SOUTHWESTERN NIGERIAN CITIES

Umar Obafemi Salisu [1]*, ORCID: 0000-0003-1630-3420,
Samuel G. Odewumi [2], ORCID: 0000-0001-7262-0362,
Forson Ibraheem Abdul-Azeez [2], ORCID: 0000-0002-6279-0445,
Margaret Emem Ogunbiyi [3], ORCID: 0000-0003-2922-8386

[1]*Department of Urban and Regional Planning, Olabisi Onabanjo University, Ago-Iwoye, +234, Nigeria*
[1, 2,3]*School of Transport and Logistics, Lagos State University, Ojo, +234, Nigeria*
[3]*Department of Transport Planning and Management, Bells University of Technology, Ota, +234, Nigeria*
*Corresponding author: Umar Obafemi Salisu, *umar.salisu@oouagoiwoye.edu.ng*

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Abstract. Public transport contributes significantly to the development of socioeconomic activities and the long-term sustainability of all communities worldwide. Undoubtedly, it is a catalyst for maximizing quality urban living, social service accessibility, and environmental balance. Despite its considerable importance and benefits, public transport in Nigeria is still poorly practiced, and plagued by complex operational challenges. Based on this context, we assessed the public transport systems in Ikeja-Lagos, Abeokuta, and Ibadan cities to understand the struggle for sustainability in Nigeria. This study examined the socioeconomic and travel characteristics of passengers, the availability and condition of public transport infrastructural facilities, peculiar public transport challenges, and the best possible strategies to sustain public transport systems in Nigeria. The study employed a cross-sectional survey research design, while a multistage sampling technique was utilized to administer a well-validated questionnaire on the passengers at central transport nodes within the selected cities using both descriptive and inferential analysis. The results show that most of the respondents are men and spend more than 10% of their monthly income on public transport usage. Findings show that conventional public transport has been proven unpopular in Ibadan and Abeokuta cities compared to a chaotic and inadequate bus rapid system in Ikeja-Lagos. Findings also revealed traffic signal and control devices, and terminal facilities as top-two rated public transport facilities in good condition. The study revealed that public transport modes across the selected cities are operationally cracked as they are characterized by unprecedented challenges. The results of the Analysis of Variance established a statistical significant variation among the challenges mitigating sustainable public transport in the selected Nigerian cities. The study concludes and recommends, among other measures, full-adoption of appropriate mass transit options, particularly intra-city rail and the development of multimodal transport system.

Keywords: *Cities, Nigeria, public transport system, sustainable transport, transport planning.*

Rezumat. Transportul public contribuie semnificativ la dezvoltarea activităților socioeconomice și la sustenabilitatea pe termen lung a comunităților din întreaga lume. Fără îndoială, este un catalizator pentru maximizarea calității vieții urbane, accesibilitatea serviciilor sociale și echilibrul mediului. În ciuda importanței și beneficiilor considerabile, transportul public din Nigeria este încă slab practicat și este afectat de provocări operaționale complexe. Pe baza acestui context, am evaluat sistemele de transport public din orașele Ikeja-Lagos, Abeokuta și Ibadan pentru a înțelege lupta pentru durabilitate din Nigeria. Acest studiu a examinat caracteristicile socioeconomice și de călătorie ale pasagerilor, disponibilitatea și starea infrastructurii de transport public, provocările specifice transportului public și cele mai bune strategii posibile pentru a susține sistemele de transport public din Nigeria. Studiul a folosit un design transversal de cercetare prin sondaj, în timp ce o tehnică de eșantionare în mai multe etape a fost utilizată pentru administrarea unui chestionar validat privind pasagerii la nodurile centrale de transport din orașele selectate, folosind atât analize descriptive, cât și inferențiale. Rezultatele arată că majoritatea respondenților sunt bărbați și cheltuiesc mai mult de 10% din venitul lunar pentru utilizarea transportului public. Constatările arată că transportul public convențional este nepopular în orașele Ibadan și Abeokuta în comparație cu un sistem rapid de autobuz haotic și inadecvat din Ikeja-Lagos. Constatările au arătat, de asemenea, că dispozitivele de semnalizare și control al traficului și facilitățile terminale sunt printre cele mai bune două facilități de transport public cotate în stare bună. Studiul a dezvăluit că modurile de transport public din orașele selectate sunt dezastruoase din punct de vedere operațional, deoarece sunt caracterizate de provocări fără precedent. Rezultatele analizei variației au stabilit o variație semnificativă statistică între provocările care atenuează transportul public durabil în orașele nigeriene selectate. Studiul concluzionează și recomandă, printre alte măsuri, adoptarea integrală a opțiunilor adecvate de transport în masă, în special calea ferată intra-oraș și dezvoltarea unui sistem de transport multimodal.

Cuvinte cheie: *orașe, Nigeria, sistem de transport public, transport durabil, planificare a transportului.*

1. Introduction

Transport is a non-negotiable catalyst and livewire for the existence, survival, and sustainability of the human-made environment [1]. It has a significant impact on the constructed environment as it fosters socio-economic activities, efficient resource utilization, and environmental preservation [2]. Transport, as a facilitator of modern civilization, continues to be an essential tool through which any society develops with the right momentum, and has played extensive and pivotal roles in the transformation of any economy around the world [3]. The need for transport, which is essential to human survival and social interaction, will undoubtedly continue to grow as long as the world continues to revolve on its axis. Hence, there is no escape, as people and goods must move, and basic human needs must be sourced [4, 5]. Because of the ease of accessibility, availability, convenience, safety, speed, dependability, and responsiveness of the modes of transport, particularly the public transport option, and increasing socioeconomic activities, man and his environment have been and will continue to experience development and sustainability. Hence, the requirements for achieving a sustainable public transport system that would positively impact the growth and sustainability of local communities on all fronts must be met and not compromised [3, 6, 7].

Public transport is a shared-passenger transport service open to the general population, as opposed to modes such as taxicabs, carpooling, or leased buses, which are not used by strangers without prior private agreement. According to [8], "public transport" is described as all means of transport that have shared ridership and are available for public use, irrespective of ownership status. Public transport operations, which are an integral backbone of urban life, are a form of urban mobility options such as passenger trains, buses, bus rapid transit, trolleybuses, ferries, taxis, trams, etc., which offer lower rates, operate fixed routes, and are accessible to the public while emitting fewer carbon emissions [8, 9]. Worthwhile, the incorporation of public transport as a viable mobility option has not only provided access to employment, community services, social services, and medical care facilities, but has also ignited considerable expansion of business opportunities, socio-economic growth, reduced urban congestion, and travel time, air and water pollution, and energy consumption. It equally facilitates quality urban living and environmental balance through quality transit-oriented development for users who choose to ride (choice riders) and those who have no other choice (choice non-riders).

Sustainable public transportation is defined as meeting the environmental, social, and economic aspects of current public mobility and accessibility demands while not jeopardizing future travel and accessibility demands [1, 10, 11]. It is the capacity to satisfy mobility requirements while considering the environment, i.e., a pleasant environment with low emissions, using safe, dependable, and cost-effective modes that promote improved health and welfare of general users [6, 12, 13]. The Council of Ministers of Transport described sustainable public transport as an affordable public transport system that works fairly and effectively in large number of passenger movement through a variety of modal choices and supports balanced regional growth and a competitive economy. Nevertheless, sustainable and dependable public transportation provides a healthier contribution to the environment, social, and economic wellbeing and a potential developmental framework for the long-term achievement of a public transit-oriented community with effective infrastructural development and efficient operational service management [1].

Unfortunately, Nigerian cities face a plethora of public transportation-related challenges, as the functioning and survival of these cities rely on public transportation systems [13, 14]. It is not an overstatement that public transport which is at the heart of mobility in Nigerian cities, is rapidly becoming a catalyst for spatial insanity, land use imbalances, and urban crime promotion. Ultimately, public transport in these cities is characterized by apparent challenges, including unprecedented transit demand; low infrastructural investment; dilapidated and neglected infrastructural facilities such as bus sheds, right of way, and vehicles; complex and inappropriate services; longer and unpredictable travel time; poor transit access; poor enforcement of regulations; weak policy implementation; increasing rate of private ownership; inadequate planning; weak management structure; inadequate operational facilities and services to cope with ever-increasing demands for movement; traffic congestion; poor infrastructure capacity; poor safety measures; modal competition with other means and systematic withdrawal of government funding.

These quagmires have left the public transport system in Nigeria less prioritized, wrongly practiced, and characterized by complex, inefficient, intractable, and unsafe operational and management challenges. Meanwhile, despite many attempts by the government and experts to correct and reverse the ugly trends over the years, the

consequences of the negative externalities attributed to public transport systems on socioeconomic and environmental activities are alarming in Nigerian cities. Based on these contexts, this study examined public transport system in selected Nigerian cities towards understanding the struggles for environmental friendly public transport in Nigeria. In order to achieve this goal, specific objectives were pursued, including analyzing the socioeconomic status and travel attributes of passengers, determining the availability and condition of public transportation infrastructure facilities, identifying the peculiar challenges in mitigating sustainable public transport systems in the chosen cities in Southwestern Nigeria, and examining the best practices for sustainable public mobility in the chosen cities and other Nigerian cities.

2. Study Area and Research Methodology

2.1. Study Area

The research area includes the capital cities (Ikeja, Abeokuta, and Ibadan) of the three most populous and economically driven states, including the Lagos, Ogun, and Oyo States, in the Southwest region of Nigeria. Southwestern Nigeria comprises of six (6) states, namely Ekiti, Lagos, Ogun, Ondo, Osun, and Oyo, with a combined area of 79,048 square kilometers. It is situated between latitudes 6°N and 8½°N, as well as longitudes 3°E and 5°E.

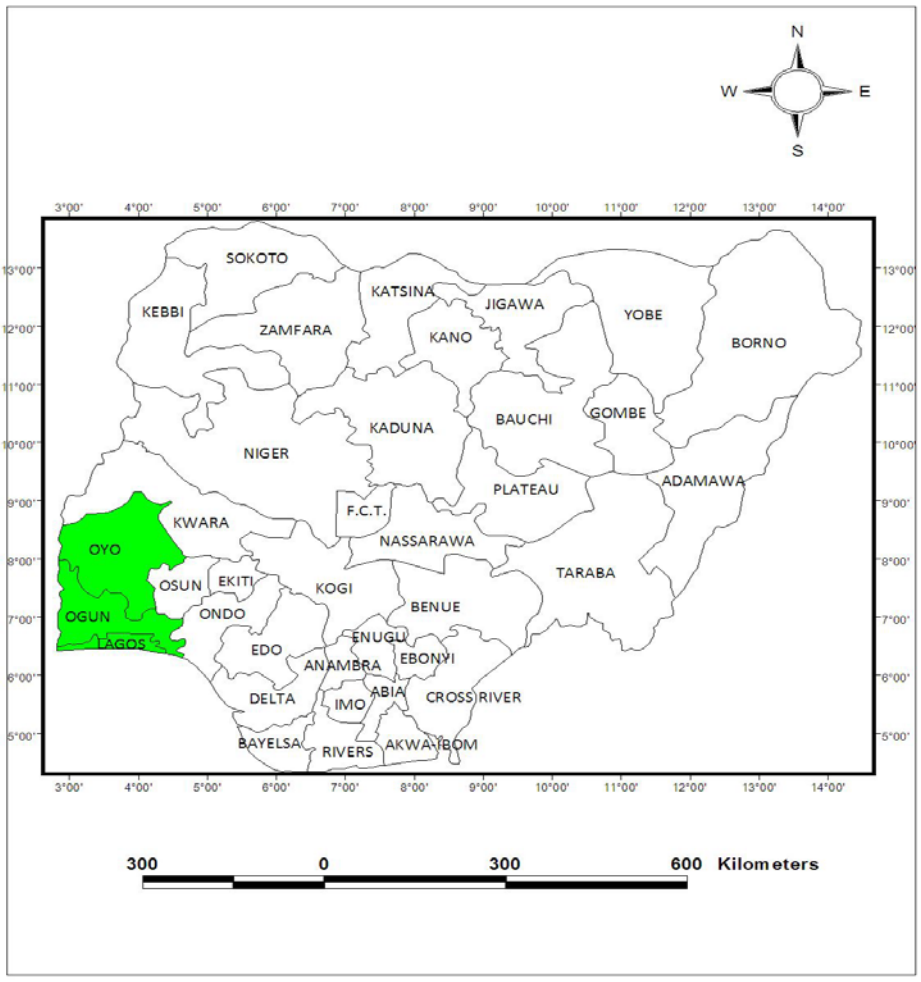

Figure 1. Nigeria showing the study area.
Sources: [1].

However, the three randomly selected capital cities are characterized by highly increasing daily mobility demand due to the apparent population advantage and socioeconomic affluence that propels rapid physical development with more functioning urban transport systems, particularly the conventional bus transit system for public transportation and enabling infrastructure including highways, rail stations, and airports.

2.2. Research Methodology

2.2.1. Research Design and Data Sources

The study adopted the cross-sectional research design, which uses survey techniques that are relatively inexpensive to collect and analyze the data. It relies on the opinions of the residents who are public transit riders or passengers "Quantitative approach" using questionnaire administration. It adopted both secondary and primary data sources. While the secondary data was utilized to prepare the manuscript and identify research gaps from both related unpublished and published articles, the primary data described the usage of a set of questionnaires given to public transport users.

2.2.2. Study population, Sample Procedure, and Sample Size

This study relies on the resident population of Lagos, Ogun, and Oyo States as the study population, using the 2021 estimated population through the 2006 national census, since it is presumed that all residents use public transport as a choice or captive rider. In other words, the public transit riders/passengers, who are the only group of respondents, were sampled using a multistage sampling technique, a probability sampling procedure. The cluster sampling technique was used in the first stage to divide the study area (the southwest of Nigeria) into groups using well-known capital cities. A simple random sampling was used to select three people for the second stage (Ikeja, Abeokuta, and Ibadan) out of six (Abeokuta, Ado-Ekiti, Akure, Ibadan, Ikeja, and Osogbo) capital cities within the southwestern states, as well as the first passenger found in the queue at the major public transport terminals within the selected cities. The third stage involved using a systematic sampling technique to select every third passenger after the first passenger had been randomly selected until the sample size (604) proportion of 297, 123, and 184 for Ikeja, Abeokuta, and Ibadan city, respectively, was reached. In other words, the 604 copies of a questionnaire were administered to the passengers found in the queue at major bus terminals within the capital cities of the selected states in a proportion of 297, 123, and 184 for Ikeja, Abeokuta, and Ibadan, respectively, based on 0.002% of the 2021 population (see Table 1) based on the assertion of [15-17].

2.2.3. Questionnaire Design and Reliability Test

The research instrument "the questionnaire" was segmented into four (4) sections. The Section A tiled the public transport passengers/riders' socioeconomic characteristics and travel characteristics, Section B addressed the availability and condition of public transport infrastructural facilities; Section C focused on peculiar challenges mitigating sustainable public transport Nigerian cities, while Section D addressed questions on the best practice for sustainable public transport in Nigeria. The questionnaire was designed using both close-ended questions. The researchers limited the administration of the self-developed and validated questionnaire across the capital cities for two weeks (Monday to Friday, excluding the days of weekend) actively between 18th and 29th January 2021. After the two weeks of data collection, 486 equivalents of 80% of completed copies of the research instrument were

retrieved and analyzed (Table 1). They adopted the Cronbach Alpha for the reliability test, and the value of the scales used read 0.84, 0.86, and 0.88 for Sections B, C, and D, respectively.

2.2.4. Data Presentation and Analysis Methods

This study adopted the 4-points multiple options Likert's scale for data collection and the frequency percentage distribution tables and Summation of Weighted Index (SWI) in the presentation of data. This was done to understand the respondents' perceptions using descriptive statistics. The Likert ratings were assigned a value of 1, 2, 3, and 4 for all the questions used in Sections B, C, and D of the scale. The Sum of Weighted Values (SWV) to estimate the Relative Mean Index (RMI) for the individual datasets. The SWV is then calculated by adding the applicable weight value associated with each rating and the number of responses to each variable. The RMI value for each variable is then calculated by dividing SWV by the total number of responses [18]. The following is how the analysis is mathematically presented:

$$\text{SWV} = \sum_{i=1}^{4} X_i\, Y_i, \tag{1}$$

where:

SWV — sum of weight value;

X_i — number of items rating i;

Yi — the weight value that was allocated (i = 1, 2, 3, 4).

$$\text{RMI} = \frac{\text{SWV}}{\sum_{i=1}^{4} i = \text{X}_i} \tag{2}$$

It must be noted that the closer the RMI of attributes is to 4 and the higher the assumed perception. Meanwhile, for the data analysis, two-point dichotomous or dummy variables of 0 and 1 was used to convert and transpose the obtained data from the qualitative form to quantitative form in order to run inferential statistics. In other words, the Analysis of Variance ANOVA, an inferential statistical technique of, was used to test the postulated research hypothesis.

Table 1

Copies of questionnaire administered to public transit riders and responses

S/n	Location	2021 Population	Sample frame %	Sample size	Completed response
1	Lagos	14,862,000	0.002	297	239
2	Ogun	6,153,869	0.002	123	100
3	Oyo	9,178,346	0.002	184	147
	Total			604	486

Source: Authors' computation, 2021.

3. Results and Discussion of Findings

3.1. Socioeconomic Status and Travel Characteristics of Respondents

3.1.1. Gender

Table 2 shows that the number of male riders interviewed is higher (70%) than their female counterpart (30%), and this dramatically implies that male riders generate more trips than female riders in the daily activities engaged.

Table 2

Gender distribution of residents

S/n	Gender	Ikeja		Ibadan		Abeokuta		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
1	Male	139	58	134	91	66	66	339	70
2	Female	100	42	13	9	34	34	147	30
	Total	239	100	147	100	100	100	486	100

Source: Author's survey, 2021.

3.1.2. Age Distribution

Table 3 revealed the respondents' population's age range. It was observed that the bulk of respondents (87%), who are defined as frequent public transit riders are below 40 years, while less than 20% account for the riders who are aged 40 and above. This result implies that the age bracket that formed the active age group makes more trips due to their various socioeconomic engagements.

Table 3

Age distribution of residents

S/n	Age	Ikeja		Ibadan		Abeokuta		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
1	Below 30yrs	131	55	102	69	64	64	297	61
2	30-39yrs	72	30	29	20	23	23	124	26
3	40-49yrs	28	12	11	7	13	13	52	11
4	50yrs and Above	8	3	5	3	-	-	13	3
	Total	239	100	147	100	100	100	486	100

Source: Author's survey, 2021.

3.1.3. Occupational Status

It was observed that the majority (32%) of the respondents work as civil or public servants (Table 4). The results show that the government workers recorded the most percentage ahead of other occupational statuses due to the socio-economic status of these cities, housing various public institutions that attract a large number of residents generating daily trips.

Table 4

Occupation status of respondents

S/n	Occupation	Ikeja		Ibadan		Abeokuta		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
1	Student	70	29	39	27	11	11	120	25
2	Company Employee	31	13	6	4	8	8	45	9
3	Self Employed	28	12	31	21	29	29	88	18
4	Unemployed	12	5	47	32	4	4	63	13
5	Civil/Public Servant	90	38	18	12	48	48	156	32
6	Others	8	3	6	4	-	-	14	3
	Total	239	100	147	100	100	100	486	100

Source: Author's survey, 2021.

3.1.4. Income Status of Respondents

Individual income which helps in determining and shaping the economic condition of a person, is considered relevant as it reveals the economic status of respondents, which perhaps will have an impact on the mobility demands of respondents. Table 5 revealed that the majority (57%) of the respondents earn below 50,000 Nigeria naira (₦) monthly as their basic salary. This result is no doubt true as the finding supported that of [1, 13, 17] that shows that the majority of urban dwellers in Nigeria patronize public transport mode just because of their low financial status.

Table 5

Income status of respondents

S/N	Monthly Income	Ikeja		Ibadan		Abeokuta		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
1	Below ₦50,000	138	58	83	56	58	58	279	57
2	₦50,000 - ₦100,000	45	19	30	20	30	30	106	22
3	₦101,000 - ₦100,000	28	12	21	14	8	8	57	12
4	Above ₦150,000	20	8	4	3	-	-	24	5
5	No Response	8	3	9	6	4	4	21	4
	Total	239	100	147	100	100	100	486	100

Source: Author's survey, 2021.

3.1.5. Portion of Income Spent on Public Transport Ride

The portion of income spent on transport is a significant factor in measuring the economic wellbeing of an individual and how sustainable the public transport system within the cities is. Table 6 revealed the portion of income spent on transport. About 66% of those surveyed, reported spending less than 21% of their income on travel to and from work. Based on this high level of the portion of income spent on public transport, it could be argued that the provision of the public transport system operation and services within the study area is not sustainable as [12] opined that for any society to claim that is transportation system is sustainable, then the level of income spent on public transport ride should not exceed 10%.

Table 6

The portion of income spent on public transport ride

S/n	The Portion of Income Spent	Ikeja		Ibadan		Abeokuta		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
1	0-10%	60	25	43	29	23	23	126	26
2	11%-20%	125	52	49	33	19	19	193	40
3	21%-30%	42	18	31	21	44	44	117	24
4	31%-40%	8	3	9	6	8	8	25	5
5	41%-50%	4	2	15	10	4	4	27	6
6	Above 50%	-	-	-	-	3	3	3	1
	Total	239	100	147	100	100	100	486	100

Source: Author's survey, 2021.

3.1.6. Nature of Trip Purpose

From the findings presented in Table 7, it is crystal clear that the trip from home to work ahead of other respondents' trip purposes accounted for the most generated urban trip through public transport mode across the selected cities. Importantly, this finding revealed

why most of the fast-growing Nigerian cities' road networks are usually congested during the morning peaks and evening peaks due to the traffic rush based on the sample trip purposes. This finding nevertheless corroborated that of [9, 13, 14, 17] and reiterated that most urban transport trips are purposely generated for work and or related purposes.

Table 7

Nature of Trip Purpose

S/n	Trip Purpose	Ikeja		Ibadan		Abeokuta		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
1	Home to market	60	25	43	29	23	23	126	26
2	Home to work	125	52	49	33	19	19	193	40
3	Home to school	42	18	31	21	44	44	117	24
4	Home to a place of worship	8	3	9	6	8	8	25	5
5	Home to eat out	4	2	15	10	4	4	27	6
6	Home to a recreation center	-	-	-	-	3	3	3	1
	Total	239	100	147	100	100	100	486	100

Source: Authors' survey, 2021.

3.1.7. Form of Public Transport Mode

Table 8 revealed that the majority (70%) of the respondents observed that they usually make use of non-conventional public transport such as commercial mini-buses, motorcycles, tricycles, or auto-rickshaw to accomplish their daily mobility needs. This finding is quite essential as it shows that the public transport mode readily available for users' patronage is the non-conventional modes usually provided by the private individual and operated basically to convey little or small individuals at a go, unlike the conventional bus mode that is designed to convey a large number of riders ultimately.

Table 8

Form of public transport mode

S/n	Form	Ikeja		Ibadan		Abeokuta		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
1	Non-conventional	139	58	134	91	66	66	339	70
2	Convention Bus/ Rapid Transit	100	42	13	9	34	34	147	30
	Total	239	100	147	100	100	100	486	100

Source: Author's survey, 2021.

3.1.8. Patronage of the Public Transport Mode

To comprehend how often people use public transport in the selected cities, respondents were asked to indicate their rate of usage of public transport mode in a week. Findings in Table 9 show that the majority use the shared urban mobility means actively between five (5) to seven (7) times with an average of six (6) times a week, while those who ride on public transport once a week accounted for the most minor level among others.

Table 9

Patronage of the Public Transport Modes

S/N	Patronage Level	Ikeja		Ibadan		Abeokuta		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
1	Once a week (1)	20	8	26	18	5	5	51	11
2	2-4 times (3)	56	23	29	20	17	17	102	21
3	5-7 times (6)	131	55	78	53	59	59	268	55
4	Above 7 times (8)	32	14	14	9	19	19	65	13
	Total	239	100	147	100	100	100	486	100

Source: Author's survey, 2021.

3.2. Availability and Condition of Public Transport Infrastructural Facilities

The appropriateness of public transport infrastructure facilities is no doubt a prerequisite for achieving sustainable public transport operations. Therefore, assessing the state of public transport infrastructure in Nigerian cities will help determine the measures to be taken on the provision and investment of public transport facilities capable of enhancing sustainable development in the selected cities. The condition of the infrastructure facilities for public transport that are currently available in the selected Nigerian cities is analyzed in Table 10. The responses were scored using a Likert scale with four possible outcomes: inappropriate (I = 1), slightly inappropriate (SI = 2), appropriate (A = 3), and adequately appropriate (AA = 4). Following this analysis, the results presented in Table 10 yield the Mean Index Value (MIV) of 1.8298 and Relative Mean Index (RMI) values. Worthwhile, when the predicted MIV of 1.8298 was compared to the twenty (20) public transport infrastructure facilities located throughout the selected cities, eight (8) out of the twenty (20) analyzed evaluated facilities were graded above the MIV. As a result, most facilities are completely in poor condition.

In the meantime, it is crucial to remember that only the traffic signal, signs and control devices (2.2222), terminal facilities, e.g., seats and safety tools (2.2181), lighting around transit facilities at night (2.0967), bus and other road-based vehicles (2.0453), railway tracks/ tramway (1.9053), bus terminal structure (with or without shed) (1.8909), dedicated fixed routes for road-based mode (1.8807) and road-rail-ferry and airport terminal linkages (1.8477) are top rated facilities and thus regarded as appropriate in conditions, while the remaining facilities such as condition of passenger trains /coaches, capacity of road-based network, first and last mile facilities, walkway and cycle paths along and around transit facilities, among others are no doubt ranked least below the MIV.

Table 10

Condition of public transport infrastructural facilities in the selected cities

s/n	Facilities	I	SI	A	AA	TWV	RMI	MIV	RK
1	Railway tracks/ tramway	210	328	180	208	926	1.9053		5
2	Dedicated fixed routes for mass transit	190	420	120	184	914	1.8807		7
3	Passenger trains /coaches	264	240	225	108	837	1.7222		15
4	The capacity of road-based network	350	156	96	104	706	1.4527		20
5	Bus and other road-based public vehicles	200	160	570	64	994	2.0453	1.8298	4

Continuation Table 10

6	First and last mile facilities	320	60	270	184	834	1.7160	16
7	Rail terminal and terminus	280	178	225	168	851	1.7510	14
8	Traffic signal, signs, and control devices	171	152	597	160	1080	2.2222	1
9	Parking facilities	296	192	180	136	804	1.6543	18.5
10	Road-rail furniture	280	152	264	168	864	1.7778	10.5
11	Road-rail-ferry and airport terminal linkages	250	200	288	160	898	1.8477	8
12	Bus terminal structure (with shed)	190	420	105	204	919	1.8909	6
13	Lighting around transit facilities at night	160	400	135	324	1019	2.0967	3
14	Walkway and cycle paths	270	220	180	184	854	1.7572	13
15	Terminal facilities, e.g., seats and safety tools	170	160	588	160	1078	2.2181	2
16	Waterways/ ferry routes	296	192	165	156	809	1.6646	17
17	Ticketing/waiting room with relaxing facilities	264	240	165	188	857	1.7634	12
18	Security post with rescue/recovery team	296	192	180	136	804	1.6543	18.5
19	Transit information center	270	200	180	224	874	1.7984	9
20	Ferry and other water vehicles	280	152	264	168	864	1.7778	10.5

Note: AA- Adequately Appropriate; A-Appropriate; SI-Slightly Inappropriate; I-Inappropriate; MIV- Mean Index Value; RMI- Relative Mean Index; TWV- Total Weighted Value; RK- Ranking Order.

Source: Author's survey, 2021.

3.3. The Challenges Mitigating Sustainable Public Transport in the Selected Cities

Table 11 presents the analyzed challenges of public transport in the context of the selected Nigerian cities. The opinions of the respondents were graded using a Likert scale with four points: Strongly Disagree (SD=1), Disagree (D=2), Agree (A=3), and Strongly Agree (SA=4). The predicted mean index value (MIV) of 2.8798 and RMI values are the results of the further analysis. Worthwhile, twenty-five (25) reported challenges of public transport system in the study area were compared to the estimated MIV of 2.8798, and it was found that a total of fourteen (14), accounting for close to two third of the evaluated challenges ranked over the MIV score. The top-rated obstacles affecting the growth and sustainability of public transport systems in selected cities are: the inadequate funding (3.1605), low investment in public transport infrastructure (3.1502), inadequate and appalling nature of public transport facilities (3.0597), unprecedented population growth (3.0000), insufficient shared modal operational facilities including buses (2.9877), poor fleet maintenance and physical distribution (2.9856), absence of clear-cut public transportation policy (2.9815), unpredictable and uncontrolled fare charges (2.9753), trade union crisis (2.9403), lack of support facilities for the elderly and physically disabled (2.9342), poor design of the railroad network's carrying capacity (2.9342), traffic congestion (2.9239), the high rate of crime and insecurity (2.9136), and the absence of a database of public transport facilities and users for planning purposes (2.9136).

Other rated challenges include corruption and mismanagement of funds (2.8519), unfavorable political decisions (2.8025), poor public transport management and planning mechanisms (2.8436), lack of credit facilities for private investors (2.8025), critical road safety issues with parking difficulties (2.8025), insufficient transport professional involvement in planning, policies and project execution (2.5802), inadequate private sector investment in public transport (2.8560), the increasing spread of smaller unit vehicles (2.6872) *etc*. ranked below the MIV. However, in reality, these quagmires impair not just the spatial development, but also the viability of the Nigerian transport sector.

Table 11

The challenges mitigating sustainable public transport in the selected cities

Indicators	SD	D	A	SA	TWV	RMI	MIV	RK
Unprecedented population growth	52	120	630	656	1458	3.0000		4
Inadequate funding	46	80	570	840	1536	3.1605		1
Absence of a clear-cut public transport policy	27	150	792	480	1449	2.9815		7
Insufficient shared modal operational facilities, including buses	26	64	1050	312	1452	2.9877		5
Inadequate private sector investment in infrastructural provision	16	380	600	320	1316	2.7078	2.8798	21
The proliferation of smaller vehicles for commuting	46	180	960	120	1306	2.6872		22
Inadequate workforce for operational coordination	42	150	840	356	1388	2.8560		15
Environmental peculiarities	40	400	510	304	1254	2.5802		23.5
Lack of support facilities for the elderly and physically disabled	34	120	888	384	1426	2.9342		10.5
Critical road safety problems with parking difficulties	42	176	840	304	1362	2.8025		19.5
Absence of credit facilities for private investors	40	192	750	400	1382	2.8436		17.5
Low investment in public transport infrastructure	51	70	570	840	1531	3.1502		2
Poor fleet maintenance and physical distribution	81	90	480	800	1451	2.9856		6
Absence of a database of public transport facilities and users for planning purposes	46	120	810	440	1416	2.9136		13.5
Insufficient transport professional involvement in planning, policies, and project execution	40	400	510	304	1254	2.5802		23.5
Traffic congestion	39	110	888	384	1421	2.9239		12
Trade union crisis	47	110	792	480	1429	2.9403		9
Poor design of the railroad network carrying capacity	34	120	888	384	1426	2.9342		10.5
Corruption and mismanagement of fund	56	120	810	400	1386	2.8519		16
Unfavorable political decision	42	176	840	304	1362	2.8025		19.5
Poor public transport management and planning mechanisms	40	192	750	400	1382	2.8436		17.5
Inadequate and appalling nature of public transport facilities	51	148	468	820	1487	3.0597		3

Continuation Table 11

The unpredictable and uncontrolled fare charges	34	120	828	464	1446	2.9753	8
The high rate of crime and insecurity	46	120	810	440	1416	2.9136	13.5
Unprecedented use of high energy consuming vehicles	40	400	510	304	1253	2.5802	25

Note: SA- Strongly Agree; A-Agree; D-Disagree; SD-Strongly Disagree; RMI- Relative Mean Index; TWV- Total Weighted Value; RK- Ranking Order; MIV- Mean Index Value.

Source: Author's survey, 2021.

3.4. The Best Practice for Sustainable Public Transport in the Selected Cities

To make public transport systems in the selected cities and other Nigerian cities effective, efficient, and sustainable, the best possible options presented and reviewed in Table 12 must be chosen and implemented. The findings of the best possible measures for sustaining public transport system in the selected cities are summarized in Table 12. The responses were scored on a four-point Likert scale, with the gradation of Strongly Disagree (SD = 1), Disagree (D = 2), Agree (A = 3), and Strongly Agree (SA = 4). The findings of this investigation reveals a predicted MIV score of 2.8798 and RMI values. When the predicted MIV of 2.9417 was compared to the fourteen (14) best possible approaches for achieving environmental friendly public transport system, eight (8) of the fourteen (14) evaluated provided grades higher than the MIV score. It is worth noting that the increasing provision of rail-based public transport (3.1605), establishing an adequate funding mechanism (3.1502), strengthening road transport facilities provision and maintenance (3.0597), increasing the road-based mass transit capacity (3.0000), and establishing a public-transit authority with a data-unit (2.9877), strict adherence to transport professionals during programs and projects execution (2.9856), strengthening regulations by restricting the use of smaller unit vehicles (2.9815), and adoption of pricing mechanisms (2.9753) are the top-rated measures for improving the growth and sustainability of public transport systems in the selected cities and other Nigerian cities with similar public transport problems.

Table 12

Best possible options and practices for sustaining public transport

s/n	Indicators	SD	D	A	SA	TWV	RMI	MIV	RK
1	Strengthening investment in rail-based public transportation	46	80	570	840	1536	3.1605		1
2	Strengthening road infrastructure provision and maintenance	51	148	468	820	1487	3.0597		3
3	Improving the road-based mass transit	52	120	630	656	1458	3.0000		4
4	Establishment of public-transit authority with data-unit	26	64	1050	312	1452	2.9877	2.9417	5
5	Strengthening advocacy and investment in research development	16	380	600	320	1316	2.7078		13
6	Support for non-motorized modes for urban commuting	40	192	750	400	1382	2.8436		12
7	Access restriction on the use of the smaller vehicles (regulation approach)	27	150	792	480	1449	2.9815		7
8	Full implementation of the use of pricing mechanisms	34	120	828	464	1446	2.9753		8

Continuation Table 12

9	Strengthening transportation policy	46	120	810	440	1416	2.9136		10.5
10	Adequate funding	51	70	570	840	1531	3.1502		2
11	Strict adherence to transport professional in programs and projects executions	81	90	480	800	1451	2.9856		6
12	Use of electronic-driven vehicles	46	120	810	440	1416	2.9136		10.5
13	Strengthening operational facilities provision	40	400	510	304	1254	2.5802		14
14	Adoption of the intelligent transport system and tech. solutions	39	110	888	384	1421	2.9239		9

Note: SD-Strongly Disagree, D-Disagree, A-Agree, SA- Strongly Agree; TWV- Total Weighted Value; RMI- Relative Mean Index; MIV- Mean Index Value; RK- Ranking Order.

Source: Author's survey, 2021.

3.5. Hypothesis Testing

H_0: There is no statistical variation among the identified challenges mitigating sustainable public transport in the selected cities.

The finding of the analysis of variance (ANOVA) presents the F-ratio of 2816.48 and a calculated significant value of 0.000 and the table significant value or the confidence level of 0.05 (see Table 13). When comparing the two values, it was observed that the significant calculated value is 0.000 is relatively low to the value of the confidence level. As a result, we accept H1 (alternative hypothesis) and reject H_0 (null hypothesis). This result means that there is statistically substantial heterogeneity across the cited constraints to sustainable public transportation in the selected Nigerian cities.

Table 13

Result of the ANOVA on identified challenges mitigating the sustainable public transport

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2354.000	1	2354.000	2816.487	.000
Within Groups	405.360	485	.836		
Total	2759.360	486	2354.836		

4. Conclusions

The study assessed the struggle for sustainable public transport in Nigerian communities using the three capital cities within Southwestern Nigeria. Worthwhile, this study revealed the need to strategically improve the quality and standard of public transport in the selected cities system in the selected cities is not only paramount to achieving sustainable transport development in these cities but also to improve the residents' and cities' socio-economic development. As observed, the public transport system, which is expected to be functionally effective and efficient, is being faced with alarming and worrisome operational and management challenges. Although the precise externalities in each chosen city varied in number, they have similar impacts of social vices, economic vigor, and environmental consequences in the built environment. Collectively, the prevalence of these externalities related to public transportation is not unconnected to three important changes in the development of transportation: rising rates of motorization and car ownership causing perpetual congestion; systematic withdrawal of the government from ongoing provision of

high-occupancy public transportation and multimodal infrastructure investment; and inadequate formulation and implementation of transport policies across the nation, Nigeria. These three great changes have enormous consequences on the sustainability of the public transport system in Nigerian cities. Specifically, aside from the fact that the traffic signal and management devices are in good condition in the study areas, most of the public transport infrastructure and support facilities, particularly the width capacity of the road network, first and last mile facilities, parking facilities, road-based vehicles, inland waterways, passenger trains, and coaches are inappropriate and in poor condition in the selected Nigerian cities. In other words, this study concludes that overall public transport in the selected cities is characterized by the intractable, worrisome, chaotic, and complex operations and apparent management externalities. Hence, these cities are seriously in need of sustainable public transport measures.

Based on the study findings and conclusion, the following vital strategies were put forth as recommendations to ensure the sustainability of public transport in Nigerian cities: (1) investment in rail-based intra-city transport; (2) strengthening road infrastructure construction and maintenance; (3) strengthening bus rapid transit; (4) strengthening transport policy implementation; (5) support for non-motorized modes usage; (6) establishment of public-transit authority with data-unit; (7) strengthening advocacy and investment in transport research development and database. The practical implications of these measures will go a long way to improving the quality of public transport services and their sustainability, thus impacting the lives of every user and ensuring seamless urban mobility across the selected cities and other Nigerian cities with similar challenges.

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Submission of manuscripts: jes@meridian.utm.md